CLAIMS

What is claimed is:

1. A method for computing a value comprising:

encoding a program of computable functions to describe computation of the value to be computed;

continualizing the encoded program;

expressing the continualized, encoded program as a differential operator;

instantiating the differential operator in a physical medium; and

extracting from the physical medium a solution for the continualized, encoded program.

2. The method of claim 1 wherein the encoding a program of computable functions further includes:

for each point $(x_0, x_1, \ldots, x_{N-1})$ in the domain $S_1 \times S_2 \times \cdots \times S_N$ of computable functions a mapping given by:

$$F : \left[0, 1, \ldots, p^{N-1}\right] \to [0, 1, \ldots, p]$$

where

$$x = \sum_{s=0}^{N-1} x_s \cdot p^{N-1-s}$$

and p is a natural number defined by:

$$p = \max_{i,d} \left\{ \left\{ N_i \middle| i = 1, \ldots, N \right\}, N_d \right\} + 1$$

and

$$F_i(x) = \begin{cases} f_i(x_0, \ldots, x_{N-1}) & \text{if defined} \\ 0 & \text{otherwise} \end{cases}$$

3. The method of claim 2 wherein continualizing the encoded program further includes determining an interpolating function $\Phi(x)$ of the encoded program $F(x)$.

4. The method of claim 3 wherein continualizing the encoded program further includes parameterizing the interpolating function $\Phi(x)$, by the recursion relation $\boldsymbol{x}_{n+1} = \boldsymbol{x}_n + a_n \boldsymbol{h}(\boldsymbol{x}_n)$, where $\{\boldsymbol{x}_0, \boldsymbol{x}_1, \ldots\}$ is a sequence of real vectors.

5. The method of claim 4 wherein the iteration $\boldsymbol{x}_{n+1} = \boldsymbol{x}_n + a_n \boldsymbol{h}(\boldsymbol{x}_n)$ is transformed into a first-order, time-dependent differential equation $\dot{\boldsymbol{x}}(t) = \boldsymbol{h}(\boldsymbol{x}(t)) - \dot{\boldsymbol{g}}(t, a, \boldsymbol{b})$ where the solution vector $\boldsymbol{x}(t)$ defines a path on a carrier manifold.

6. The method of claim 5 wherein the first-order, time-dependent differential equation $\dot{\boldsymbol{x}}(t) = \boldsymbol{h}(\boldsymbol{x}(t)) - \dot{\boldsymbol{g}}(t, a, \boldsymbol{b})$ is used to formulate a Lagrangian $L(\boldsymbol{x}, \dot{\boldsymbol{x}}, t)$.

7. The method of claim 6 wherein the Lagrangian $L(\boldsymbol{x}, \dot{\boldsymbol{x}}, t)$ is converted to the classical Hamiltonian given by:

$$H(\boldsymbol{x}, \boldsymbol{p}, t) = \sum_k \frac{p_k^2}{2m_k} + V = E$$

where V is the potential energy function of $\boldsymbol{x}$ or both $\boldsymbol{x}$ and t, and E is the energy of the system

8. The method of claim 7 wherein expressing the continualized, encoded function as a differential operator further includes converting the classical Hamiltonian $H(x, p, t)$ into a quantum, canonical, Hamiltonian operator given by:

$$H\left(x, \frac{\hbar}{i}\frac{\partial}{\partial x}, \frac{\partial}{\partial t}\right) = \sum_k -\frac{\hbar^2}{2m_k}\frac{\partial^2}{\partial x_k^2} + V = i\hbar\frac{\partial}{\partial t}$$

where $\frac{\partial^2}{\partial x_k^2}$ and $\frac{\partial}{\partial t}$ are the coördinate and time differential operators.

9. The method of claim 8 wherein instantiating the differential operator in a physical medium further includes realizing the quantum, canonical, Hamiltonian operator.

10. The method of claim 9 wherein instantiating the differential operator in a physical medium further includes impinging a quantum processor.

11. The method of claim 10 wherein instantiating the differential operator in a physical medium further includes collecting the light radiation emitted from the quantum processor.

12. The method of claim 11 wherein collecting the emitted light radiation further includes converting the emitted light radiation into a coherent spectrum of intensities versus vibrational frequencies.

13. The method of claim 12 wherein instantiating the differential operator in a physical medium further includes storing a running average of the spectrum of vibrational intensities given by:

$$\{\bar{\lambda}_1, \bar{\lambda}_2, \ldots\}$$

14. The method of claim 13 wherein extracting from the physical medium a solution for the continualized, encoded program further includes constructing a polynomial approximation of the function $\Phi(x)$ given by:

$$\Phi(x) = \sum_{k \in [0, p^{N-1}]} \sqrt{\lambda_k} \phi_k(x)$$

15. The method of claim 14 wherein extracting from the physical medium a solution further includes determining the encoded program $F(x)$ from the polynomial approximation of the function $\Phi(x)$.

16. The method of claim 15 wherein extracting from the physical medium a solution further includes determining computable functions from the encoded program $F(x)$.

17. A quantum processor comprising:
one or more nodes;
one or more bonds connecting the nodes to form a lattice;
one or more reflector plates; and
one or more insulating boundaries.